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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/540,564	06/24/2005	Shigeki Nomura	P28019	6422
7055	7590	02/05/2009	EXAMINER	
GREENBLUM & BERNSTEIN, P.L.C. 1950 ROLAND CLARKE PLACE RESTON, VA 20191				TURNER, KATHERINE ANN
ART UNIT		PAPER NUMBER		
1795				
		NOTIFICATION DATE		DELIVERY MODE
		02/05/2009		ELECTRONIC

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

gbpatent@gbpatent.com  
pto@gbpatent.com

<b>Office Action Summary</b>	<b>Application No.</b>	<b>Applicant(s)</b>	
	10/540,564	NOMURA ET AL.	
	<b>Examiner</b>	<b>Art Unit</b>	
	Katherine Turner	1795	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

#### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) Responsive to communication(s) filed on 06 October 2008.  
 2a) This action is **FINAL**.                    2b) This action is non-final.  
 3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) Claim(s) 1-40 is/are pending in the application.  
 4a) Of the above claim(s) 33-36 and 40 is/are withdrawn from consideration.  
 5) Claim(s) \_\_\_\_\_ is/are allowed.  
 6) Claim(s) 1-32 and 37-39 is/are rejected.  
 7) Claim(s) \_\_\_\_\_ is/are objected to.  
 8) Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) The specification is objected to by the Examiner.  
 10) The drawing(s) filed on 24 June 2005 is/are: a) accepted or b) objected to by the Examiner.  
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
 Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).  
 11) The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

- 12) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
 a) All    b) Some \* c) None of:  
 1. Certified copies of the priority documents have been received.  
 2. Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
 3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)  | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)   | Paper No(s)/Mail Date. _____ .                                    |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)<br>Paper No(s)/Mail Date <u>11/22/2005, 12/3/2007</u> . | 5) <input type="checkbox"/> Notice of Informal Patent Application |
|  | 6) <input type="checkbox"/> Other: _____                          |

## **DETAILED ACTION**

### ***Response to Amendment***

1. The amendment filed June 24, 2005 has been entered. Claims 1-40 are pending. Claims 21, 26 and 35 are amended. Claims 37-40 are added.

### ***Election/Restrictions***

2. Applicant's election without traverse of Group I, Species I-1, claims 1-32 in the reply filed on October 6, 2008 is acknowledged. Newly added claims 37-39 belong to elected Group I, Species I-1, and newly added claim 40 belongs to Group II. Accordingly claims 33-36 and 40 are withdrawn from consideration as being directed to a non-elected invention. See 37 CFR 1.142(b) and MPEP § 821.01.

### ***Priority***

3. Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

### ***Information Disclosure Statement***

4. The listing of references in the specification is not a proper information disclosure statement. 37 CFR 1.98(b) requires a list of all patents, publications, or other information submitted for consideration by the Office, and MPEP § 609.04(a) states, "the list may not be incorporated into the specification but must be submitted in a separate paper." Therefore, unless the references have been cited by the examiner on form PTO-892, they have not been considered.

***Claim Interpretation***

5. The claim limitation recited in claim 1, "alkylene group" is being interpreted as written in the specification "- (CH<sub>2</sub>)<sub>n</sub> -" (page 21, lines 4-11).

***Claim Rejections - 35 USC § 112***

6. Claim 21 recites the limitation "of at least one compound selected from the group consisting of organic-inorganic composite crosslinking agent (F) and siloxane oligomer (H)" and is dependent on claim 15 which depends on claim 1, but there is no recitation of a composite crosslinking agent (F) or a siloxane oligomer (H) in claims 1 or 15. There is insufficient antecedent basis for this limitation in the claim.

7. Claim 37 recites the limitation "of at least one compound selected from the group consisting of organic-inorganic composite crosslinking agent (F) and hydrolyzable metal compound (G)" and is dependent on claim 18 which depends on claim 1, but there is no recitation of a composite crosslinking agent (F) or a hydrolyzable metal compound (G) in claims 1 or 18. There is insufficient antecedent basis for this limitation in the claim.

8. Claim 38 recites the limitation "of at least one compound selected from the group consisting of hydrolyzable metal compound (G) and siloxane oligomer (H)" and is dependent on claim 19 which depends on claim 1, but there is no recitation of a

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hydrolyzable metal compound (G) or a siloxane oligomer (H) in claims 1 or 19. There is insufficient antecedent basis for this limitation in the claim.

9. Claim 23 recites the limitation "of at least one compound selected from the group consisting of organic-inorganic composite crosslinking agent (F), hydrolyzable metal compound (G) and siloxane oligomer (H)" and is dependent on claim 23 which depends on claim 1, but there is no recitation of a organic-inorganic composite crosslinking agent (F), a hydrolyzable metal compound (G) or a siloxane oligomer (H) in claims 1 or 23.

There is insufficient antecedent basis for this limitation in the claim.

***Claim Rejections - 35 USC § 102***

10. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

11. Claims 1-13, 15-23 and 37-39 are rejected under 35 U.S.C. 102(e) as being anticipated by Nomura et al. (US 7,214,756).

The applied reference has common inventors (Shigeki Nomura; Kenji Yamuchi; Satoshi Koma) and assignee (Sekisui Chemical Co., Ltd.) with the instant application. Based upon the earlier effective U.S. filing date of the reference, it constitutes prior art

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under 35 U.S.C. 102(e). This rejection under 35 U.S.C. 102(e) might be overcome either by a showing under 37 CFR 1.132 that any invention disclosed but not claimed in the reference was derived from the inventor of this application and is thus not the invention "by another," or by an appropriate showing under 37 CFR 1.131.

Regarding claim 1, Nomura et al. discloses a method for producing the proton conducting membrane having a sulfonic acid group that has a crosslinked structure represented by formula (2) and formula (6), as seen below, which comprises a first step of preparing a mixture containing a mercapto group-containing oligomer (E) and a reactive group compound (C) which can form a Si-O-Si bond by condensation reaction, a second step of forming the mixture into a film (Applicant's membrane), a third step of hydrolyzing and condensing the film material in the presence of a catalyst to obtain a crosslinked structure in the film and a fourth step of oxidizing a mercapto group into sulfonic acid (Applicant's gel)(column 7, lines 27-55; column 19, lines 15-45; column 24, lines 57-67; column 25, lines 1-5; column 31, lines 34-43; column 34, lines 44-50).



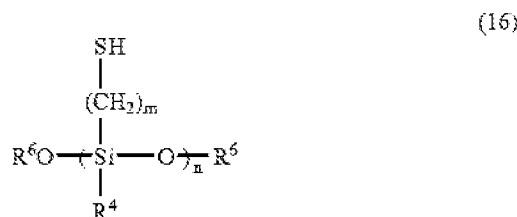
(wherein, X is an —O— bond or OH group involved in the crosslinking; R<sup>3</sup> is a molecular chain group having at least one acid group; R<sup>4</sup> is methyl, ethyl, propyl or phenyl group; and "m" is an integer of 0, 1 or 2).

When the acid group is sulfonic acid, R<sup>3</sup> preferably has a structure represented by the general formula (6):



(wherein, "n" is an integer of 1 to 20).

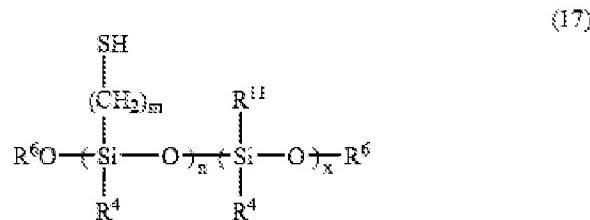
Regarding claims 2-4, Nomura et al. discloses the mercapto group-containing oligomer (formula 16), please see below, with a plurality of mercapto groups, the compound commercialized by Shin-etsu Silicones (X-41-1805) where R<sup>4</sup> (Applicant's R<sup>8</sup>) is OCH<sub>3</sub>, m is 3, and n is 10 (column 33, lines 14-60).



(wherein, R<sup>5</sup> is H, or CH<sub>3</sub>, C<sub>2</sub>H<sub>5</sub>, C<sub>3</sub>H<sub>7</sub> or C<sub>6</sub>H<sub>5</sub> group; R<sup>4</sup> is CH<sub>3</sub>, C<sub>2</sub>H<sub>5</sub>, C<sub>3</sub>H<sub>7</sub>, C<sub>6</sub>H<sub>5</sub>, OH, OCH<sub>3</sub>, OC<sub>2</sub>H<sub>5</sub>, OC<sub>6</sub>H<sub>5</sub> group, or O—Si bond; "m" is an integer of 1 to 20; and "n" is an integer of 3 to 500).

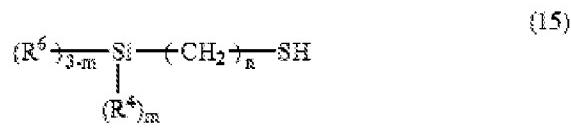
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Regarding claims 5-7, Nomura et al. discloses the compound, please see formula (17) below, and the compound commercialized by Shin-etsu Silicones (X-41-1810) where R<sup>4</sup> (Applicant's R<sup>8</sup>) is OCH<sub>3</sub>, m is 3, and "n+x" (Applicant's "n+t" is around 10, and that the oligomer is obtained by the combination of 3-mercaptopropyltrimethoxysilane and tetraethoxysilane or tetramethoxysilane, which Applicant states produces a compound of formula (6) wherein R<sup>9</sup> is OCH<sub>3</sub> or OC<sub>2</sub>H<sub>5</sub> (Applicant's specification page 61, lines 12-18) (Nomura et al.'s column 29, lines 54-67; column 32, lines 65-67; column 34, lines 11-35).



(wherein, R<sup>6</sup> is H, or CH<sub>3</sub>, C<sub>2</sub>H<sub>5</sub>, C<sub>3</sub>H<sub>7</sub> or C<sub>6</sub>H<sub>5</sub> group; R<sup>4</sup> is CH<sub>3</sub>, C<sub>2</sub>H<sub>5</sub>, C<sub>3</sub>H<sub>7</sub>, C<sub>6</sub>H<sub>5</sub>, OH, OCH<sub>3</sub>, OC<sub>2</sub>H<sub>5</sub> or OC<sub>6</sub>H<sub>5</sub> group; R<sup>11</sup> is a substitute of 6 carbon atoms or less; "m" is an integer of 1 to 20; "n" is an integer of 3 to 500; and "n+x" is an integer of 500 or less, where the unit containing mercapto group and that containing R<sup>11</sup> may be present in a block or random form).

Regarding claim 8, Nomura et al. discloses the compound of the formula (15) below (column 32, lines 50-65).



(wherein, R<sup>4</sup> is methyl, ethyl, propyl or phenyl group; R<sup>6</sup> is Cl, or OCH<sub>3</sub>, OC<sub>2</sub>H<sub>5</sub>, OC<sub>6</sub>H<sub>5</sub>, OH or OCOC<sub>2</sub>H<sub>5</sub> group; "m" is 0, 1 or 2; and "n" is an integer of 1 to 20).

Regarding claim 9, Nomura et al. discloses 3-mercaptopropyltrimethoxysilane and 3-mercaptopropyltriethoxysilane (column 32, lines 50-67).

Regarding claim 10, Nomura et al. discloses 3-mercaptopropylmethyldimethoxysilane and mercaptomethyldiethoxysilane (column 33, lines 1-2).

Regarding claim 11, Nomura et al. discloses 3-mercaptopropyltrimethoxysilane, 3-mercaptopropyltriethoxysilane, and mercaptopropylmethyldimethoxysilane (column 32, lines 50-67; column 33, lines 1-2).

Regarding claims 12-13, Nomura et al. discloses tetraethoxysilane, tetramethoxysilane (column 29, lines 64-67).

Regarding claims 15-17, Nomura et al. discloses the first step further involves blending a hydrolyzable silyl compound including alkoxysilicates, e.g. tetraethoxysilane, tetramethoxysilane, tetraisopropoxysilane, tetra-n-butoxysilane, tetra-t-butoxysilane, and monoalkyl and dialkyl derivatives thereof (column 29, lines 64-67; column 30, line 1).

Regarding claim 18, Nomura et al. discloses the first step further involves the blending of a sioxane oligomer such as, polydimethylsiloxane with silanol at both terminals (column 27, lines 62-67; column 28, lines 1-20).

Regarding claims 19-20, Nomura et al. discloses the first step further involves the blending of bis(triethoxysilyl)ethane, with m representing an integer of 0 (column 27, lines 1-30).

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Regarding claims 21, 37-38, Nomura et al. discloses 1.0 g of bis(diethoxymethylsilyl)octane and 0.5 g of 3-mercaptopropyltrimethoxysilane (column 42, lines 40-55), thus 200 parts by weight of sioxane oligomer based on 100 parts by weight of mercapto group-containing oligomer.

Regarding claim 22, Nomura et al. discloses an acid, e.g., hydrochloric, sulfuric or phosphoric acid as catalyst (column 31, lines 34-40).

Regarding claim 23, Nomura et al. discloses a basic catalyst, e.g., ammonia or sodium hydroxide (column 31, lines 34-40).

Regarding claim 39, Nomura et al. discloses 1.0 g of bis(diethoxymethylsilyl)octane and 0.5 g of 3-mercaptopropyltrimethoxysilane (column 42, lines 40-55), thus 200 parts by weight of sioxane oligomer based on 100 parts by weight of mercapto group-containing oligomer.

### ***Claim Rejections - 35 USC § 103***

12. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

13. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.

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3. Resolving the level of ordinary skill in the pertinent art.
  4. Considering objective evidence present in the application indicating obviousness or nonobviousness.
14. Claim 14 is rejected under 35 U.S.C. 103(a) as being obvious over by Nomura et al. (US 7,214,756), as applied to claims 1-13, 15-23 and 37-39 above.

The applied reference has common inventors (Shigeki Nomura; Kenji Yamuchi; Satoshi Koma) and assignee (Sekisui Chemical Co., Ltd.) with the instant application. Based upon the earlier effective U.S. filing date of the reference, it constitutes prior art only under 35 U.S.C. 102(e). This rejection under 35 U.S.C. 103(a) might be overcome by: (1) a showing under 37 CFR 1.132 that any invention disclosed but not claimed in the reference was derived from the inventor of this application and is thus not an invention "by another"; (2) a showing of a date of invention for the claimed subject matter of the application which corresponds to subject matter disclosed but not claimed in the reference, prior to the effective U.S. filing date of the reference under 37 CFR 1.131; or (3) an oath or declaration under 37 CFR 1.130 stating that the application and reference are currently owned by the same party and that the inventor named in the application is the prior inventor under 35 U.S.C. 104, together with a terminal disclaimer in accordance with 37 CFR 1.321(c). This rejection might also be overcome by showing that the reference is disqualified under 35 U.S.C. 103(c) as prior art in a rejection under 35 U.S.C. 103(a). See MPEP § 706.02(l)(1) and § 706.02(l)(2).

Regarding claim 14, Nomura et al. discloses tetraethoxysilane, tetramethoxysilane, tetraisopropoxysilane, tetra-n-butoxysilane, tetra-t-butoxysilane,

and monoalkyl and dialkyl derivatives thereof (column 29, lines 64-67; column 30, line 1). The mono alkyl and dialkyl overlap in range with R<sup>6</sup>'s groups.

In the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art" a prima facie case of obviousness exists. *In re Wertheim*, 541 F.2d 257, 191USPQ 90 (CCPA 1976); *In re Woodruff*, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir. 1990); *In re Geisler*, 116 F.3d 1465, 1469-71, 43 USPQ2d 1362, 1365-66 (Fed. Cir. 1997). See MPEP 2144.05.

15. Claims 24 and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nomura et al. (US 7,214,756), as applied to claims 1-23 and 37-39 above, and further in view of Yamatani et al. (JP08134219, please refer to IPDL JPO machine translation for citation).

Nomura et al. discloses a basic hydrolysis catalyst, e.g. ammonia or sodium hydroxide (column 31, lines 34-40), but is silent as to it being an organic amine or potassium fluoride and ammonium fluoride.

Yamatani et al. teaches that organic amines, potassium fluoride and ammonium fluoride are art recognized equivalents for basic catalysts such as ammonia or sodium hydroxide (paragraphs 54 and 55).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to utilize organic amines, potassium fluoride and ammonium fluoride as the basic catalyst in replacement of basic catalysts such as ammonia or sodium hydroxide, because Yamatani et al. teaches that organic amines, potassium

fluoride and ammonium fluoride are art recognized equivalents for basic catalysts such as ammonia or sodium hydroxide (paragraphs 54 and 55).

16. Claim 25 is rejected under 35 U.S.C. 103(a) as being unpatentable over Nomura et al. (US 7,214,756) and Yamatani et al. (JP08134219), as applied to claims 1-24, 26 and 37-39 above, and further in view of Muramoto et al. (US 4,985,342).

Nomura et al. discloses a hydrolysis catalyst, e.g. hydrochloric acid or sulfuric acid (column 31, lines 34-40), but is silent as to it being an organic amine.

Muramoto et al. teaches that hydrolysis catalysts e.g. hydrochloric acid or sulfuric acid are art recognized equivalents for organic bases e.g. triethylamine (column 6, lines 4-23).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to utilize triethylamine in replacement for hydrochloric acid or sulfuric acid, because Muramoto et al. teaches that hydrolysis catalysts e.g. hydrochloric acid or sulfuric acid are art recognized equivalents for organic bases e.g. triethylamine (column 6, lines 4-23).

17. Claims 27-32 is rejected under 35 U.S.C. 103(a) as being unpatentable over Nomura et al. (US 7,214,756) and Yamatani et al. (JP08134219) and Muramoto et al. (US 4,985,342), as applied to claims 1-26 and 37-39 above, and further in view of Barss et al. (US 6,623,639).

Regarding claims 26-29 and 32, Nomura et al. is silent as to micropore-forming agent.

Barss et al. teaches a fuel cell membrane (column 5, lines 44-57) with a polyethylene glycol micropore former that is added to the membrane mixture, formed into a membrane and then rinsed out of the membrane through dissolution, and then crosslinking the membrane (column 3, lines 25-35; column 4, lines 46-58), and that the addition of this micropore former in this method provides high porosity leading to high gas permeance while maintaining high tensile strength (column 3, lines 1-24).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to add Barss et al.'s micropore forming agent polyethylene glycol into the membrane mixture with the same molecular weights and weight percentages as Barss et al., to rinse the micropore forming agent out of membrane through dissolution, and then to crosslink the membrane, because Barss et al. teaches that the addition of this pore former in this method provides high porosity leading to high gas permeance while maintaining high tensile strength (column 3, lines 1-24).

The steps of crosslinking the membrane and dissolution of the poreformer are not in the same order as claimed. In general, the transposition of process steps or the splitting of one step into two, where the processes are substantially identical or equivalent in terms of function, manner and result, was held to be not patentably distinguish the processes. *Ex parte Rubin*, 128 USPQ 440 (Ed. Pat. App.1959). See MPEP 2144.04.

Regarding claim 30, Nomura et al. modified by Barss et al. teaches the polyethylene glycol having a molecular weight of at least about 1000 Daltons, and also teaches that poly functional ethylene glycol (Applicant's polyethylene glycol) of molecular weight less than 100 Daltons can be used (Barss et al. column 3, lines 25--53).

In the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art" a prima facie case of obviousness exists. *In re Wertheim*, 541 F.2d 257, 191USPQ 90 (CCPA 1976); *In re Woodruff*, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir. 1990); *In re Geisler*, 116 F.3d 1465, 1469-71, 43 USPQ2d 1362, 1365-66 (Fed. Cir. 1997). See MPEP 2144.05.

Regarding claim 31, Nomura et al. modified by Barss et al. are silent as to the amount of micropore-forming agent by weight based on the mercapto group containing oligomer.

Barss et al. teaches that the pore formers produce the pores, and that porosity is a result that can be obtained (column 3, lines 17-53). Thus the amount of pore formers is a variable that determines the amount of porosity.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to vary the amount of pore forming agent, because oligomer.

Barss et al. teaches that the pore formers produce the pores, and that porosity is a result that can be obtained (column 3, lines 17-53). Thus the amount of pore formers is a variable that determines the amount of porosity. *Discovery of optimum value of*

*result effective variable in known process is ordinarily within skill of art.* In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

18. Claims 1-11, 14-15, and 21-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Slade et al. (Robert C.T. Slade, John R. Varcoe, Proton conductivity in siloxane and ormosil ionomers prepared using mild sulfonation methodologies, Solid State Ionics, 2001, 145, pages 127-133) and Fujinami et al. (JP2002184427, please refer to IPDL JPO machine translation for citation).

Regarding claim 1, Slade et al. discloses a polymeric material used for ion exchange or ion conductivity applications (Section 1. Introduction) having a crosslinked structure formed by a silicon-oxygen covalent bond and having a sulfonic acid-containing crosslinked structure represented by formula (1) wherein X represents and -O- bond taking part in crosslinking, R<sup>1</sup> represents C<sub>3</sub>H<sub>6</sub>, and R<sup>2</sup> represents an -O- bond taking part in crosslinking (Scheme 1), which comprises the first step of preparing a mixture containing a mercapto group oligomer in scheme 1, from starting material such as 3-mercaptopropyltrimethoxysilane and 3-mercaptopropylmethyldimethoxysilane (Section 2. Materials Preparation, second paragraph), a second step of subjecting the material to a condensation reaction in the presence of a hydrochloric acid catalyst to obtain a crosslinked material, and the last step of oxidizing the mercapto group in the material so that it is converted to a sulfonic acid group (Scheme 1; Section 1. Introduction; Section 2. Materials Preparation), but Slade et al. is silent to the proton conducting material being formed into a membrane.

Fujinami et al. teaches proton conductor material can formed into a good film (Applicant's membrane) by mixing it with polymers, this proton conducting film having simple manufacturing method and high proton conductivity (paragraphs 4 and 10).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to mix Fujinami et al.'s polymers with Slade et al.'s proton conducting material to produce a good film, because Fujinami et al. teaches that this produces a good proton conducting film having simple manufacturing method and high proton conductivity (paragraphs 4 and 10).

The step of forming the membrane is now the fourth step. In general, the transposition of process steps or the splitting of one step into two, where the processes are substantially identical or equivalent in terms of function, manner and result, was held to be not patentably distinguish the processes. *Ex parte Rubin*, 128 USPQ 440 (Ed. Pat. App.1959). See MPEP 2144.04.

Regarding claim 2, Slade et al. discloses the mercapto group containing oligomer in scheme 1 has a plurality (x) of mercapto groups (Scheme 1).

Regarding claims 3-4, Slade et al. discloses the mercapto group oligomer in Scheme 2, from starting material such as 3-mercaptopropyltrimethoxysilane and 3-mercaptopropylmethyldimethoxysilane, this oligomer has R<sup>7</sup> of CH<sub>3</sub>, R<sup>8</sup> is OCH<sub>3</sub> or CH<sub>3</sub>, m is 3, and n is x (Scheme 2; Section 2. Materials Preparation, second paragraph), but is silent as to what x is equal to.

Slade et al. discloses that the sulfonic acid functionalities are what provides the proton ion exchange and conductivity features (Section 1. Introduction), thus the more

sulfonic acid functionalities the more proton ion exchange and conductivity features to the material.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to vary the number of sulfonic acid functionalities, which are varied by varying the x (Applicant's n), because Slade et al. teaches that the sulfonic acid functionalities are what provides the proton ion exchange and conductivity features (Section 1. Introduction), thus the more sulfonic acid functionalities the more proton ion exchange and conductivity features to the material. *Discovery of optimum value of result effective variable in known process is ordinarily within skill of art.* In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

Regarding claims 5-7, Slade et al. discloses the mercapto group oligomer in Scheme 1, from starting material such as 3-mercaptopropyltrimethoxsilane and 3-mercaptopropylmethyldimethoxsilane, this oligomer has R<sup>7</sup> of CH<sub>3</sub>, R<sup>8</sup> is OCH<sub>3</sub>, R<sup>9</sup> is CH<sub>3</sub>, m is 3, and n is x (Scheme 1; Section 2. Materials Preparation, second paragraph), but is silent as to what x is equal to.

Slade et al. discloses that the sulfonic acid functionalities are what provides the proton ion exchange and conductivity features (Section 1. Introduction), thus the more sulfonic acid functionalities the more proton ion exchange and conductivity features to the material.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to vary the number of sulfonic acid functionalities, which are varied by varying the x (Applicant's n), because Slade et al. teaches that the sulfonic acid

functionalities are what provides the proton ion exchange and conductivity features (Section 1. Introduction), thus the more sulfonic acid functionalities the more proton ion exchange and conductivity features to the material. *Discovery of optimum value of result effective variable in known process is ordinarily within skill of art.* In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

Regarding claims 8-11, Slade et al. discloses 3-mercaptopropyltrimethoxysilane and 3-mercaptopropylmethyldimethoxysilane (Section 2. Materials preparation).

Regarding claims 14-15, Slade et al. discloses diethoxydimethylsilane (Scheme 1, Section 2. Materials preparation).

Regarding claim 21, Slade et al. discloses that the preparation of the materials have been reported in Evans et al. (Philip J. Evans, Robert C.T. Slade, John R. Varcoe and Kevin E. Young, Journal of Materials Chemistry, 1999, 9, pages 3015-3021).

Evans et al. evidences that the 3-mercaptopropyltrimethoxysilane was added in 5.00g, and the diethoxydimethylsilane was added in 3.77g (page 3015, column 2, paragraph 3), this being less than 200 parts by weight based on 100 parts by weight of the mercapto group-containing oligomer.

Regarding claim 22, Slade et al. discloses the catalyst is hydrochloric acid (Scheme 1 and 2).

19. Claims 12-13 and 16-17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Slade et al. (Robert C.T. Slade, John R. Varcoe, Proton conductivity in siloxane and ormosil ionomers prepared using mild sulfonation methodologies, Solid

State Ionics, 2001, 145, pages 127-133) and Fujinami et al. (JP2002184427) as applied to claims 1-11, 14-15, and 21-22 above, and further in view of Mikhailenko et al. (S. Mikhailenko, D. Desplantier-Giscard, C. Danumah, S. Kaliaguine, Solid electrolyte properties of sulfonic acid functionalized mesostructured porous silica, Microporous and Mesoporous Materials, 2002, 52, pages 29-37).

Slade et al. discloses diethoxydimethylsilane (Scheme 1, Section 2. Materials preparation), but is silent as to all there being less than two alkyl groups in the silane.

Mikhailenko et al. teaches synthesis of proton conducting material from condensation of 3-mercaptopropyltrimethoxysilane with tetraethoxysilane and methyltrimethoxysilane and that the amount of methylsilane functionality increases or decreases the hydrophobicity of the material (Section 2.1 Synthesis of sulfonic-functionalized mesoporous material).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to vary the number of alkyl groups in the silane, because Mikhailenko et al. teaches that the amount of methylsilane functionality increases or decreases the hydrophobicity of the material (Section 2.1 Synthesis of sulfonic-functionalized mesoporous material). *Discovery of optimum value of result effective variable in known process is ordinarily within skill of art.* In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

20. Claims 23-24, 26 and 39 are rejected under 35 U.S.C. 103(a) as being unpatentable over Slade et al. (Robert C.T. Slade, John R. Varcoe, Proton conductivity

in siloxane and ormosil ionomers prepared using mild sulfonation methodologies, Solid State Ionics, 2001, 145, pages 127-133), Fujinami et al. (JP2002184427) and Mikhailenko et al. (S. Mikhailenko, D. Desplantier-Giscard, C. Danumah, S. Kaliaguine, Solid electrolyte properties of sulfonic acid functionalized mesostructured porous silica, Microporous and Mesoporous Materials, 2002, 52, pages 29-37) as applied to claims 1-17, and 21-22 above, and further in view of Yamatani et al. (JP08134219, please refer to IPDL JPO machine translation for citation).

Slade et al. discloses hydrochloric acid as the hydrolysis catalyst (Scheme 1 and 2), but is silent as to a basic catalyst, such as an organic amine, or potassium fluoride and ammonium fluoride.

Yamatani et al. teaches that organic amines, potassium fluoride and ammonium fluoride are art recognized equivalents for basic catalysts such as ammonia or sodium hydroxide (paragraphs 54 and 55).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to utilize organic amines, potassium fluoride and ammonium fluoride as the hydrolysis catalyst in replacement of hydrochloric acid, because Yamatani et al. teaches that hydrochloric acid, organic amines, potassium fluoride and ammonium fluoride are art recognized equivalents for hydrolysis catalysts (paragraphs 54 and 55).

Regarding claim 39, Slade et al. discloses that the preparation of the materials have been reported in Evans et al. (Philip J. Evans, Robert C.T. Slade, John R. Varcoe and Kevin E. Young, Journal of Materials Chemistry, 1999, 9, pages 3015-3021).

Evans et al. evidences that the 3-mercaptopropyltrimethoxysilane was added in 5.00g, and the diethoxydimethylsilane was added in 3.77g (page 3015, column 2, paragraph 3), this being less than 200 parts by weight based on 100 parts by weight of the mercapto group-containing oligomer.

21. Claim 25 is rejected under 35 U.S.C. 103(a) as being unpatentable over Slade et al. (Robert C.T. Slade, John R. Varcoe, Proton conductivity in siloxane and ormosil ionomers prepared using mild sulfonation methodologies, Solid State Ionics, 2001, 145, pages 127-133), Fujinami et al. (JP2002184427), Mikhailenko et al. (S. Mikhailenko, D. Desplantier-Giscard, C. Danumah, S. Kaliaguine, Solid electrolyte properties of sulfonic acid functionalized mesostructured porous silica, Microporous and Mesoporous Materials, 2002, 52, pages 29-37) and Yamatani et al. (JP08134219) as applied to claims 1-17, 21-24, 26, and 39 above, and further in view of Muramoto et al. (US 4,985,342).

Slade et al. discloses hydrochloric acid as the hydrolysis catalyst (Scheme 1 and 2), but is silent as to it being an organic amine.

Muramoto et al. teaches that hydrolysis catalysts e.g. hydrochloric acid are art recognized equivalents for organic bases e.g. triethylamine (column 6, lines 4-23).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to utilize triethylamine in replacement for hydrochloric acid, because Muramoto et al. teaches that hydrolysis catalysts e.g. hydrochloric acid or sulfuric acid

are art recognized equivalents for organic bases e.g. triethylamine (column 6, lines 4-23).

22. Claim 27-32 is rejected under 35 U.S.C. 103(a) as being unpatentable over Slade et al. (Robert C.T. Slade, John R. Varcoe, Proton conductivity in siloxane and ormosil ionomers prepared using mild sulfonation methodologies, Solid State Ionics, 2001, 145, pages 127-133), Fujinami et al. (JP2002184427), Mikhailenko et al. (S. Mikhailenko, D. Desplantier-Giscard, C. Danumah, S. Kaliaguine, Solid electrolyte properties of sulfonic acid functionalized mesostructured porous silica, Microporous and Mesoporous Materials, 2002, 52, pages 29-37), Yamatani et al. (JP08134219) and Muramoto et al. (US 4,985,342) as applied to claims 1-17, 21-26 and 39 above, and further in view of Barss et al. (US 6,623,639).

Regarding claims 26-29 and 32, Slade et al. is silent as to micropore-forming agent.

Barss et al. teaches a fuel cell membrane (column 5, lines 44-57) with a polyethylene glycol micropore former that is added to the membrane mixture, formed into a membrane and then rinsed out of the membrane through dissolution, and then crosslinking the membrane (column 3, lines 25-35; column 4, lines 46-58), and that the addition of this micropore former in this method provides high porosity leading to high gas permeance while maintaining high tensile strength (column 3, lines 1-24).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to add Barss et al.'s micropore forming agent polyethylene glycol

into the membrane mixture with the same molecular weights and weight percentages as Barss et al., to rinse the micropore forming agent out of membrane through dissolution, and then to crosslink the membrane, because Barss et al. teaches that the addition of this pore former in this method provides high porosity leading to high gas permeance while maintaining high tensile strength (column 3, lines 1-24).

The steps of crosslinking the membrane and dissolution of the poreformer are not in the same order as claimed. In general, the transposition of process steps or the splitting of one step into two, where the processes are substantially identical or equivalent in terms of function, manner and result, was held to be not patentably distinguish the processes. *Ex parte Rubin*, 128 USPQ 440 (Ed. Pat. App.1959). See MPEP 2144.04.

Regarding claim 30, Slade et al. modified by Barss et al. teaches the polyethylene glycol having a molecular weight of at least about 1000 Daltons, and also teaches that poly functional ethylene glycol (Applicant's polyethylene glycol) of molecular weight less than 100 Daltons can be used (Barss et al. column 3, lines 25--53).

In the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art" a prima facie case of obviousness exists. *In re Wertheim*, 541 F.2d 257, 191USPQ 90 (CCPA 1976); *In re Woodruff*, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir. 1990); *In re Geisler*, 116 F.3d 1465, 1469-71, 43 USPQ2d 1362, 1365-66 (Fed. Cir. 1997). See MPEP 2144.05.

Regarding claim 31, Slade et al. modified by Barss et al. are silent as to the amount of micropore-forming agent by weight based on the mercapto group containing oligomer.

Barss et al. teaches that the pore formers produce the pores, and that porosity is a result that can be obtained (column 3, lines 17-53). Thus the amount of pore formers is a variable that determines the amount of porosity.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to vary the amount of pore forming agent, because oligomer.

Barss et al. teaches that the pore formers produce the pores, and that porosity is a result that can be obtained (column 3, lines 17-53). Thus the amount of pore formers is a variable that determines the amount of porosity. *Discovery of optimum value of result effective variable in known process is ordinarily within skill of art. In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

### ***Double Patenting***

23. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the “right to exclude” granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement.

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

24. Claims 1-13 and 15-21 are provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-39 of copending Application No. 11/727,036. Although the conflicting claims are not identical, they are not patentably distinct from each other because the only differences are in overlapping of the ranges in the claims.

In the case where the claimed ranges “overlap or lie inside ranges disclosed by the prior art” a prima facie case of obviousness exists. *In re Wertheim*, 541 F.2d 257, 191USPQ 90 (CCPA 1976); *In re Woodruff*, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir. 1990); *In re Geisler*, 116 F.3d 1465, 1469-71, 43 USPQ2d 1362, 1365-66 (Fed. Cir. 1997). See MPEP 2144.05.

This is a provisional obviousness-type double patenting rejection because the conflicting claims have not in fact been patented.

25. Claims 1-17, 19-20 and 23-25 are provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-39 of copending Application No. 10/559082. Although the conflicting claims are not

identical, they are not patentably distinct from each other because the only differences are in overlapping of the ranges in the claims.

In the case where the claimed ranges “overlap or lie inside ranges disclosed by the prior art” a *prima facie* case of obviousness exists. *In re Wertheim*, 541 F.2d 257, 191USPQ 90 (CCPA 1976); *In re Woodruff*, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir. 1990); *In re Geisler*, 116 F.3d 1465, 1469-71, 43 USPQ2d 1362, 1365-66 (Fed. Cir. 1997). See MPEP 2144.05.

This is a provisional obviousness-type double patenting rejection because the conflicting claims have not in fact been patented.

#### ***Correspondence/Contact Information***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Katherine Turner whose telephone number is (571)270-5314. The examiner can normally be reached on Monday through Thursday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Dah-Wei Yuan can be reached on (571)272-1295. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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Examiner, Art Unit 1795

/Dah-Wei D. Yuan/  
Supervisory Patent Examiner, Art Unit 1795